CLAIMS

What is claimed is:

1. An acoustic imaging system, comprising:

a transducer including a two-dimensional transducer element matrix array, the transducer having a protective cover configured to mate with a transducer body, the protective cover superposed above the two-dimensional transducer element matrix such that acoustic energy incident at the protective cover is mechanically directed by the protective cover and wherein the transducer element matrix array is encased by the protective cover and the transducer body; and

an image processing system coupled to the transducer configured provide a plurality of individualized excitation signals to the plurality of transducer elements over time such that the two-dimensional transducer element matrix array generates and transmits acoustic energy through the protective cover over time such that acoustic energy transmitted through the protective cover is electronically focused.

2. The acoustic imaging system of claim 1, wherein the protective cover comprises an acoustic material, the acoustic material exhibiting acoustic impedance corresponding to acoustic impedance of a body to be imaged.

3. The acoustic imaging system of claim 1, wherein at least one of the dimensions of the two-dimensional transducer element matrix array is curved.

4. The acoustic imaging system of claim 1, wherein the protective cover is constructed with a non-uniform thickness.

5. The acoustic imaging system of claim 1, wherein the protective cover has an acoustic impedance of between approximately 1.3Mrayl and 1.7MRayl.

6. The acoustic imaging system of claim 1, wherein the protective cover has a transducer-engagement having a tissue-engagement surface, the transducer-engagement end being configured to engage a transducer body, the tissue engagement surface forming a portion of a substantially cylindrical surface.

7. The acoustic imaging system of claim 6, wherein the tissue engagement surface forms a portion of a substantially spherical surface.

8. The acoustic imaging system of claim 1, wherein the transducer body is ergonomically adapted to be grasped by the hand of an operator.

9. The acoustic imaging system of claim 1, wherein the protective cover has a shape that reduces the probability of a sonographer developing a repetitive motion injury.

10. The acoustic imaging system of claim 1, wherein the image processing system electronically focuses transmitted acoustic energy at a target by compensating for the non-uniform acoustic delays caused by the protective cover.

11. The acoustic imaging system of claim 10, wherein the electronic compensation is a function of the position of the target point.

12. The acoustic imaging system of claim 1, wherein the image processing system receives a plurality of individualized receive mode signals from a plurality of transducer elements, the receive mode signals representative of the incident acoustic energy at a plurality of the transducer elements of the two-dimensional transducer element matrix array that traverses the protective cover.

13. The acoustic imaging system of claim 12, wherein the image processing system electronically focuses the acoustic energy received through the protective cover.

14. The acoustic imaging system of claim 13, wherein electronic focusing comprises compensating for the non-uniform acoustic delays caused by the protective cover.

15. The acoustic imaging system of claim 13, wherein the electronic compensation is a function of the position of the target point.

16. The acoustic imaging system of claim 15, further comprising:

means for accessing an acoustic window of a body to be imaged.

17. The acoustic imaging system of claim 16, wherein the accessing means comprises placing the transducer between adjacently disposed ribs of the body of a patient.

18. A method for acoustically imaging a patient, comprising the steps of:

providing a transducer having a two-dimensional transducer element matrix array, the transducer having a protective cover configured to mate with a transducer body, the protective cover superposed above the two-dimensional transducer element matrix such that acoustic energy transmitted from the protective cover and into the body is mechanically directed by the protective cover, wherein the two-dimensional transducer element matrix array and the protective cover are shaped to reduce patient discomfort;

generating a plurality of time delayed transmit signals to separately control individual transducer elements of the two-dimensional transducer element matrix array to electronically focus acoustic transmit waves that traverse the protective cover; and

receiving a plurality of time delayed response echoes at the separately controllable individual transducer elements of the two-dimensional transducer element matrix array to electronically focus acoustic receive echoes that traverse the protective cover.

19. The method of claim 18, further comprising the step of: processing the reflected acoustic echoes to generate an image.

20. The method of claim 18, further comprises the steps of: accessing an acoustic window of a patient; and

transmitting acoustic energy through the protective cover and into the patient via the acoustic window.

21. The method of claim 18, wherein the steps of generating and receiving further comprise:

electronically focusing the acoustic energy in an elevation dimension; and

electronically focusing the acoustic energy in a lateral dimension.

22. The method of claim 20, wherein the step of accessing an acoustic window comprises an acoustic window formed between adjacently disposed ribs of the patient.